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Willow Stake Installation: Example Contract Specifications

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PURPOSE: This technical note provides contract specifications that can be used as a template by USACE personnel for contracting the installation of willow (*Salix spp.*) stakes for streambank stabilization (Figure 1). This example provides biologists, engineers, project managers, and others with information that can be used to develop contract specifications. It is not intended as a substitute for experience, knowledge, and/or understanding of appropriate installation techniques or other streambank stabilization practices and principles.

Figure 1. Willow stake plantings (photo provided by Sotir & Associates)

BACKGROUND: Numerous examples of streambank stabilization projects that utilize willow stakes can be found in the United States. This technical note is based on actual willow stake contract specifications used for various projects within the Nashville, Vicksburg, and Rock Island Districts. Because every project has specific and unique requirements, the example presented here should be used only as a guide. This technical note was written for freshwater streams across the United States. Regional issues, such as native versus non-native species, are not addressed in this publication. In some areas, species other than willow may be appropriate and worth investigating.

INTRODUCTION: Each project has unique requirements that must be addressed when preparing contract specifications. When considering willow stakes as a method for streambank stabilization, the physical and biological requirements of willow stakes must be addressed. If willow stakes meet the project requirements, prescribed installation methods must be applied diligently to ensure willow stake success.

To ensure the best conditions for plant establishment and site stability, a number of factors must be considered including optimal season for installation, plant density, plant source (nursery grown or harvested from local areas), moisture requirements, and maintenance. For more information on technical aspects of willow stake installation, a number of good references are available, including Allen and Leach (1997), Derrick (1998), Gray and Leiser (1982), Gray and Sotir (1995), and Sotir and Fischenich (2003).

To ensure successful completion of a willow stake project, both technical and administrative matters must be addressed. Administrative details such as a completion schedule, progress reports, and

method of payment must be included in the contract. Contract specifications must be concise and explicit and should be limited to specific types of work. It is better to write multiple contracts for diverse types of project work.

Willow stake installation is labor-intensive. Service contracts secure a service based on a fixed effort (number of acres to be planted) at a fixed price (dollars/acre). Service contracts are a competitive form of procurement with the contract generally being awarded to the contractor that can provide the "best value." Best value is determined by taking into account such factors as prior experience, facilities, equipment, manpower, availability, and price. Other contract types may be more appropriate for a particular project. Contact District procurement offices at the beginning and throughout the life of a project to ensure the most appropriate vehicles are implemented in an efficient manner.

Effective contract management requires frequent meetings with the Contractor, preferably on site, to ensure an understanding of all aspects of the contract. Inspection of the work site during the life of the contract, including establishment period, is essential. Report, document, and correct all deficiencies.

The remainder of this technical note provides example contract specifications for willow stake installations. Explanatory notes are provided in text boxes throughout the example.

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REFERENCES

Allen, H. H., and Leech, J. R. (1997). "Bioengineering for streambank erosion control, Report 1 Guidelines," Technical Report EL-97-8, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Construction Specifications Institute. (1995). "MasterFormat: Master list of numbers and titles for the construction industry." Construction Specification Institute, Alexandria, VA.

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U.S. Army Corps of Engineers. (1993). "Engineering and Design: Plans and Specifications for Civil Works Projects," Engineer Regulation 1110-2-1200, Washington, DC.

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EXAMPLE CONTRACT SPECIFICATIONS[1,2]

SECTION TABLE OF CONTENTS

SECTION 02900[3]

WILLOW STAKES

PROJECT TITLE
SECTION 02900[3] – Willow Stakes

[1] All engineering and design specifications for Corps projects must be prepared in accordance with ER 1110-2-1200 and ER 1110-1-8155. All Corps offices are required to use SPECSINTACT to prepare construction specifications (HQUSACE memorandum – 14 April 1997). The Corps adopted standards from the "MasterFormat" (Construction Specifications Institute 1995).

[2] In an effort to standardize contracting requirements among federal agencies, a new set of Unified Facilities Guide Specifications have recently been approved for use by the Army, Navy, and Air Force. For an update, go to TECHINFO on the Internet at: *http://www.hnd.usace.army.mil/techinfo/gspec.htm.*

[3] This number refers to the section entitled "Bioengineering" in the MasterFormat (Construction Specifications Institute 1995). If applicable, the last two digits of the section number may be changed to reflect a more specific subsection as described in Section 02900

PART 1 GENERAL

1.1 Scope

The work covered by this section includes all labor, equipment, live cut branches, and supplies needed for the construction of bioengineering treatments in the reaches designated in the drawings[4] and as specified herein.

[4] "Drawings" are referred to throughout this technical note. In an actual contract, scale drawings showing site location and other information would be included as part of the contract. Drawings are not included here.

1.2 References

Comment: Materials, workmanship, and equipment must be described by reference to nationally recognized industry and technical society specifications and standards. Standards that are adopted as actual contract specifications should be included in the "REFERENCES" subsection. For the purposes of this example, three potentially relevant references have been listed.

The publications listed below are referred to hereafter by basic designation only and form a part of this specification to the extent indicated by the reference thereto:

ASTM International. (2003). D6765-02 Standard Practice for Live Staking.

Illinois Department of Transportation (ILDOT). (1 Jul 1994). "Standard Specifications for Road and Bridge Construction."

Tennessee Department of Transportation (TDOT). (1993). "Standard Specifications for Road and Bridge Construction."

1.3 Definitions

Comment: To ensure clear communications between the Corps and Contractors, all project-specific terms should be defined in this section.

Dormant Season – The non-growing season for woody species, when they have set their buds, and photosynthesis in the leaves has stopped (top growth is no longer occurring).

Harvesting Site – Approved existing, natural, native growing sites that lie within a 40-mile radius of the project site, or approved cultivated sites.

Toe of Bank – The break in slope at the top of the shore where the bank begins.

1.4 Contractor Qualifications

The contractor shall be a company that specializes in willow stake installation with a minimum of 5 years documented experience. The contractor shall furnish information substantiating its capability to provide staff expertise and suitable and sufficient quantity of equipment and labor to meet contract deadlines. Proof of capability will include monitoring and evaluation reports, letters of recommendation from previous clients noting specific projects, and written commentary from public agency personnel.

1.5 Submittals

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES of Corps of Engineers Guide Specification (CEGS-01330).

Comment: CEGS defines "Submittals" as "shop drawings, product data, samples, and administrative submittals presented for review and approval." This section of the contract provides details about documentation required as part of the project.

Limit submittals to those necessary for adequate quality control. One of the primary factors in determining if a submittal is required is the importance of the item to the success of the project.

Submittals may be classified as "government approval" (GA) or "for information only" (FIO). In practice, use of the designations "GA" and "FIO" varies among Districts and may have as much to do with past failures and successes with contractors as with District policy.

The submittal description "SD" numbering system comes from the Unified Facilities Guide Specifications (March 2001). Standard descriptions of 11 possible categories of submittals can be found. An update on SD designations can be found at the SpecsIntact Website: *http://specsintact.ksc.nasa.gov*

SD-01 Data
Equipment; FIO
Written description of the proper collecting, storing, shipping, handling, and planting techniques and methods, equipment, and tools to be used.

Comment: If the Corps Contracting Officer believes that there is a need for information about various aspects of the project, that information can be requested as part of the Data subsection. CEGS defines "Data" as "submittals which provide calculations, descriptions, or documentation regarding the work."

SD-08 Statements
Delivery; FIO
Delivery Schedule for equipment and plants.

Comment: The Statements subsection allows the Contracting Officer to request information about how the project will be accomplished. CEGS defines "statements" as "a document, required of the Contractor, or through the Contractor, from a supplier, installer, manufacturer, or other lower tier Contractor, for the purpose of confirming the quality, or orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel, qualifications, or other verifications of quality."

SD-13 Certificates

Prior to delivery of material, Certificates of Compliance shall be submitted certifying that materials meet the specified requirements. Where such certification requires a laboratory test, the test shall be certified and reported as part of the Certificate of Compliance. Testing shall be performed by an approved independent laboratory within 30 days of the submittal of reports. Certified copies of the reports shall be provided for the following:

a. **Plant stock. Nursery name, genetic purity, and/or location of source.**

b. **Fertilizers. Manufacturer's chemical analysis and application.**

c. **Manufacturer's data. Installation and application procedures, specification data sheet for irrigation systems.**

Comment: CEGS defines "Certificates" as "statements signed by an official authorized to certify on behalf of the manufacturer of a product, system, or material meeting specified requirements." This subsection allows the Contracting Officer to require information certifying suitability of some aspect of the quality or nature of materials or labor used in the project. In projects for which maintenance of genetic integrity of plants is considered important, this section can require certification documenting the origin of plant material. The statement must be dated after the award of the contract, must state the Contractor's name and address, project name and location, and list the specific requirements which are being certified.

SD-18- Records

Maintenance; FIO
Maintenance work performed, area repaired or reinstalled, diagnosis for unsatisfactory survival.

Comment: CEGS defines "records" as "documentation to record compliance with technical or administrative requirements. This section allows the Contracting Officer to request records documenting compliance with various contract requirements.

PART 2 PRODUCTS

2.1 Source of Plant Materials

It is the intent of this project to use woody plant cuttings collected on site. However, if top-quality cuttings are not available or are of insufficient quantity on site, then the Contractor may obtain cuttings from other local sources. Arrangements for alternate sources of woody plant cutting are completed by and at the expense of the Contractor. The Contractor shall provide the Project Manager with a Letter of Agreement signed by the Contractor and landowner specifying the terms for collection of cuttings. The Project Manager must approve the source of all cuttings, in writing. Woody plant cuttings, not collected within the project boundary, will be inspected by the Project Manager at the growing site and approved prior to delivery. Such inspection does not preclude right of rejection at the project site.

Comment: When alternate sites are used as plant sources, the Contractor must obtain approval from the landowners and regulatory agencies. In addition, care must be taken to ensure the harvest area is not denuded or damaged.

2.2 Plant Materials

Willow stakes are woody plant cuttings, capable of rooting, that are taken from trees and shrubs. All plant materials must be top quality stock. Plant materials shall be true to species. They shall be sound, healthy specimens and first-class representatives of their species. Plant materials that have serious injuries, insect pests, diseases or are shriveled, will be rejected.

Willow stakes shall be cut from approved sources using a sharp tool. Live willow stakes shall be from 5 to 8 ft in length with a basal end of 0.5 to 1.5 in. in diameter. The top ends shall be blunt; butt ends shall be angled at 45 degrees. Stakes shall be stripped of all stems and leaves, taking care to minimize scarring or bruising of the willow stakes. Immediately upon cutting, willow stakes will be placed in water in a shaded area.

2.3 Collection, Delivery, Handling, and Storage

The Contractor shall provide for the proper collection, care, storage, and handling of plant materials before planting. During all stages, the plant materials shall be protected from exposure to wind and direct sunlight.

2.3.1 Collection

Collect willow stakes while dormant, between October 1 and February 28. They shall be planted no later than May 31.

Comment: Time frames for collecting and planting willow stakes vary from region to region. Also, seasonal variations may impose an adjustment to schedules.

2.3.2 Delivery

The Contractor shall notify the Project Manager of the delivery schedule in advance so the plant materials may be inspected upon arrival at the job site. The Project Manager will inspect the cuttings for damage immediately upon receipt. Unacceptable cuttings will be removed from the job site immediately and disposed of at an authorized site.

2.3.3 Handling

Install willow stakes within 6 hr of collection. If planting does not occur within 6 hr, plant material must be properly stored according to the guidelines given in the following section (Part 2.3.4.).

2.3.4 Storage

All woody plant cuttings collected more than 12 hr prior to installation, must be carefully bound, secured, and stored submerged in clean fresh water for a period of up to two weeks. Outdoor temperatures must be less than 50 degrees F and temperature indoors and in storage containers must be between 34 and 50 degrees F. If the willow stakes cannot be installed during the dormant season, cut during the dormant season and hold in cold storage at temperatures between 33 and 39 degrees F for up to 2 months.

2.3.5 Miscellaneous Materials

The contractor will provide and install materials appropriate to irrigate the willow stakes for a period of two growing seasons or until the willow stakes are established, as indicated by foliage development.

PART 3 EXECUTION

3.1 Site Preparation

Grade the bank geometry of the project area to a uniform 3:1 slope. Log revetments shall be placed upstream of the project area per project design specifications described in the site drawing. The Contractor shall be responsible for correcting any erosion damage prior to planting.

Recommendation: Geomorphic characteristics such as bank geometry are important for the success of a project. Eroded, undercut, or steep slopes require grading prior to installation. The slope angle varies with soil type. For instance, sand has an angle of repose of approximately 30 deg, whereas clay can withstand a much steeper slope. Where undercutting is a problem, the toe of the bank should be protected with a hard structural treatment. (Allen and Leech 1997). It is not recommended that willow stakes be planted in areas exhibiting geotechnical failure (large block failures, soil and mud slides, etc.) (Derrick 1998).

3.2 Irrigation System Installation

A drip irrigation system that will deliver 0.5 gal per hour during dry conditions shall be installed in preparation to receiving the willow stakes and poles (see site drawing).

Recommendation: Texture, structure, and depth affect water holding capacity of a soil and need to be considered when determining water retention requirements or designing supplemental irrigation requirements (Allen and Leech 1997).

3.3 Dormant Live Stake Installation

Prior to placement or installation of willow stakes, the Contractor shall flag all plant material locations for approval. The Project Manager may require adjustments to plant material locations to meet field conditions. Actual planting shall be performed during above periods only when weather and soil conditions are suitable and in accordance with locally accepted practice, as approved by the Contracting Officer. Deviation from the above planting dates will be permitted only when approved in writing by the Contracting Officer.

Plant materials shall be placed at 4-ft intervals as indicated on the drawings and as specified and shall follow other general planting practices considered normal and prudent by nursery tradesmen. Eighty percent of the stake will be installed below ground, leaving only twenty percent of the willow stake extending above ground. Stakes shall be placed deep enough to reach wet soil during dry summers (3-5 ft).

Comment: Depth to water table varies greatly from region to region. This is a critical factor for success of the project, especially in arid and semi-arid regions. Contract specifications should reflect site-specific requirements.

Recommendation: Allen and Leech (1997) described several methods for preparing installation holes for willow stakes. In clay soils, a steel ram on an excavator boom is the most efficient technique. In stony or sandy soils, an auger on an excavator boom forms deep and long-lasting holes. On riprap, "The Stinger" is an effective method for establishing pilot holes. These criteria may be incorporated in the contract specifications.

3.4 Maintenance and Monitoring

The Contractor will maintain and monitor the project site for a period of two growing seasons. Soil moisture, appropriate for willow stake survival, will be monitored and provided via a drip irrigation system, if required. Insect or disease infestation will be treated immediately. If signs of herbivory occur, protective screen sleeves or grazing animal exclosures must be provided.

3.5 Approval and Payment

Willow stakes are measured by the surviving individual piece (the "each"). Payment for willow stakes will be made by "the each." This price shall include, but is not limited to, locating harvest areas (2-3 are preferred), harvesting the live branch materials, delivering materials, storing materials, installation of materials, deep watering (2-ft depth), weeding, insect and disease control, and maintenance until accepted.

Only living plants (branches alive and healthy at the time of final inspection) will be accepted. The Contractor is responsible for replacement of any non-living materials before final inspection, as determined by the Project Manager. All replacement will occur during the dormant season. The living stake acceptance rate is 100 percent at the end of the 2-year maintenance period.